DGDC Meeting Minutes
November 10, 2016

Attendance List:

Naomi Bates	DGS
David Bennett	DTI
Mark Biddle	DNREC
Allan Blades	Axis Geospatial
David Braig	JMT
Lori Brown	DNREC/NPS
Mary Ann Burnett	Artesian Water
Tommy Burton	Artesian Water
Eileen Capitoli	DNREC
Kim Cloud	DTI
Daniel Cook	DTI
Teryn Davidson	Kent County
Darin Dell	DTI
Mike DelTufo	DTI
James Galvin	Dover/Kent MPO
Jeremy Gibb	City of Dover
Bernie Gilbert	DelDOT
Paul Graefe	Wilmington Univ.
Allice Guerrant	DHCA
Jay Hodny	Kent County
Jimmy Kroon	DDA
Matthew Laick	DSHS
Danielle Lamborn	Kent County
Simon Lowe	Dover AFB
Morgon McGee-Solomon	DNREC
Miriam Pomilio	OSPC
Mollie Raley-Hall	DelDOT
Analisa Rusnack	US Census
Bill Seybold	DE Forest Service
Christine Smack	Tidewater Utilities
Krystal Stanley	DNREC/STRS
Eddie Starr	Pictometry
Rick Steffers	Kent County
Debbie Sullivan	DNREC/DTI
Michael Sutherland	DHCA
Doyle Tiller	OMB/DFM
Mike Townshend	DTI
Seth VanAken	Esri
Art Walker	USDA/NRCS
Carl Yetter	DE Coastal Programs

Welcome & Introductions

Deborah Sullivan started the meeting at 9:02 am. She welcomed everyone to the meeting and introductions were made.

August 11, 2016 Meeting Minutes

Mike Townshend made a motion to approve the August 11, 2016 Meeting Minutes (PDF). Dave Braig seconded the motion and it passed unanimously.

Technical Advisory Committee Update

Mike Townshend reported there is no update for the Technical Advisory Committee at this time. The next meeting is scheduled for November 18, 2016.

FirstMap Update

Kim Cloud provided a FirstMap update.

ArcGIS has been updated to 10.4.1 on test and development with success. DTI will be updating production on December 9, starting at 5:00 pm Daniel Cook commented that there will be several patches when DTI moves their servers to 10.4.1 in production, however, they did not have issues in test.

ArcGIS Desktop 10.5 is available in prerelease. The FirstMap team will be evaluating it to see if that update should be done sooner than the established “wait until version.1”.

ESRI has been working with the FirstMap Team doing an architecture review.

Sea Level rise data is available on FirstMap on the private side only.

Information was provided about the statewide outage that is being planned.

As always if you experience issues, please contact the team at FirstMap@state.de.us.

Geospatial Education Committee

Darin Dell gave an update and reported the GIS Day Committee is expecting 302 5th graders from across the state to attend this year's field trip on November 16, 2016.

Aerial Imagery Update

Kim Cloud gave an update on the Aerial Imagery RFP process indicating that the state is still working on capturing imagery in 2017.

NSGIC Conference Update

Kim Cloud reported it was a great meeting in Indianapolis this year. A lot of interesting topics were discussed. Click here to get the detailed notes from the NSGIC Annual Conference.

Presentation – Delaware Geological Survey – New Sea Level Rise Update

Naomi Bates from DGS provided a presentation on the development/update of the Sea Level Rise data she has been working on for the Delaware Coastal Program. Her slide presentation is attached.

Federal Update

Census – Analisa Rusnaek from the Philadelphia office indicated they are ramping up for the 2020 Census and will be doing a LUCA update in January. She requested information regarding partnerships for the BAS to get new and better geography for the municipalities.

USDA/NRCS – Art Walker said there will be a soils refresh coming out soon. Also mentioned that they are working on getting ArcGIS Portal for their data including LiDAR. Debbie Sullivan asked that if they start putting the soils out as a service to let FirstMap know so we can serve directly from their service.

Open Comment Period

- Lori Brown from DNREC spoke about the Delaware Land Use Project with the Chesapeake Bay.
- Rick Steffers from Kent County shared his experience with the GIS Master's degree at Salisbury University.
- Mike Townshend mentioned that DTI and OSPC are going to present information regarding FirstMap to the League of Local Governments at their December meeting.
- Seth Van Aken from ESRI demonstrated the Crowd sourced honoring our Veterans Story map. He also mentioned to look for 10.5 Regional presentations around December, and possibly working up at Show and Tell for Delaware in January. The Federal GIS User Conference is February 13 – 14 and will have an area for State and Local Governments.
- Robert Madanant from New Castle County mentioned that they have worked with John Inkster to scan 1982 high resolution imagery for the New Castle Area. Kim asked if they would provide that to FirstMap.

- Jimmy Kroon from Department of Agriculture mentioned he has built a Collector App to do inspections. They have used it to do over 1000 inspections with photos. Initially they were a year behind, but now are all caught up. Seth suggested doing an ROI study to calculate cost savings.
- Mike Townshend from DTI indicated he is working with John Inkster and Tax Ditches on a project to use drones.

Next Meeting

The 2017 DGDC Quarterly meetings have been set. They will all be at the Kent County Administrative Complex, Room 220 and start at 9:00 am on the following dates:

February 9, 2017
May 11, 2017
August 10, 2017
November 9, 2017

Adjournment

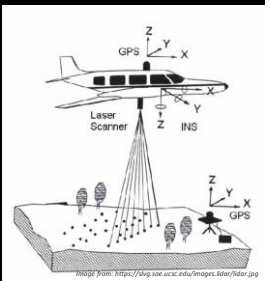
Matt Laick made a motion to adjourn the meeting and it was seconded by David Bennett. The meeting was adjourned at 10:20 am.

Delaware LiDAR Data, Derivatives, and Applications

Naomi S. Bates
Delaware Geological Survey
November 10, 2016

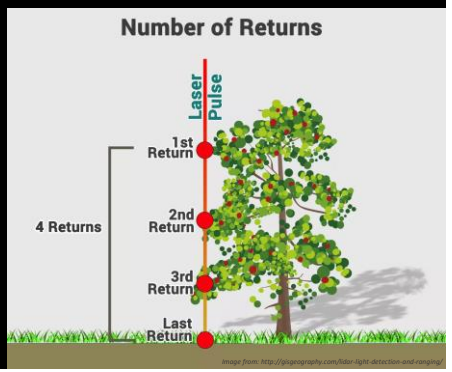
Introduction of LiDAR

- Light Detection And Ranging
- Active remote sensing



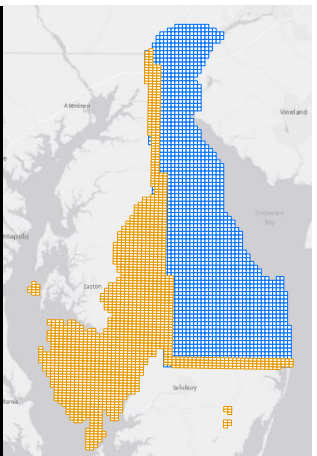
Introduction of LiDAR

- Light Detection And Ranging
- Active remote sensing
- Multiple Returns
- Intensity

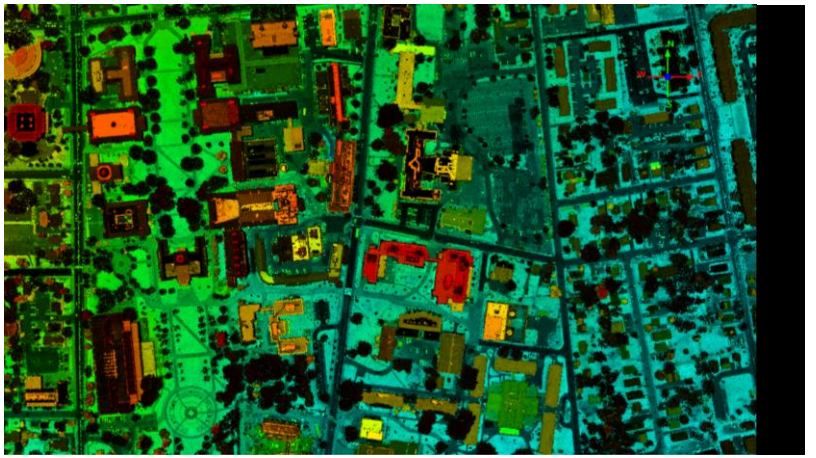


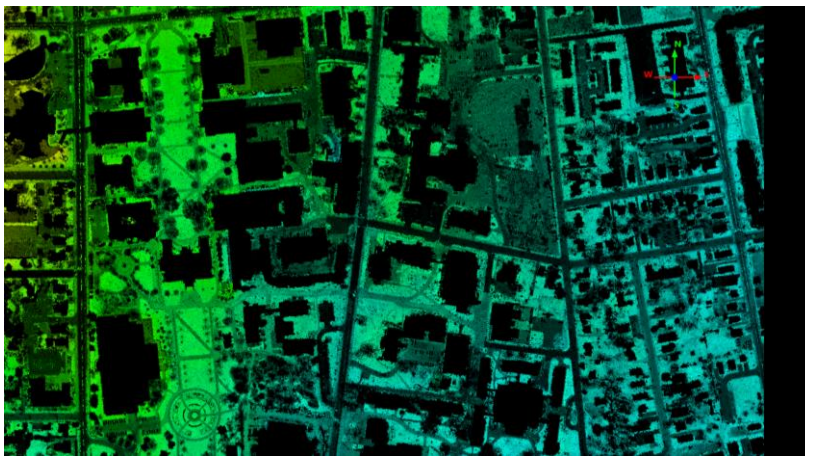
2014 Topographic (NIR) LiDAR

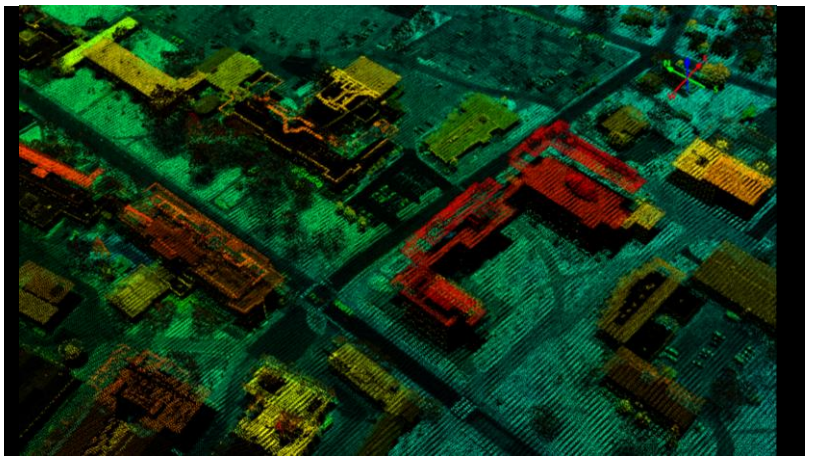
- Entire state of DE and part of MD (3000+ square miles)
- Funded through the Hurricane Sandy Supplemental Fund
  - USGS, DGS, DNREC, and DelDOT
- Quality Level 2 or better (>2 pts/m²)
- December 2013 – April 2014
- Not tide coordinated
- Reported RMSEz open terrain: 6.3 cm
- Deliverables
  - classified point cloud
  - 1-m hydro-flattened DEM
  - intensity images
  - breaklines used for hydro-flattened

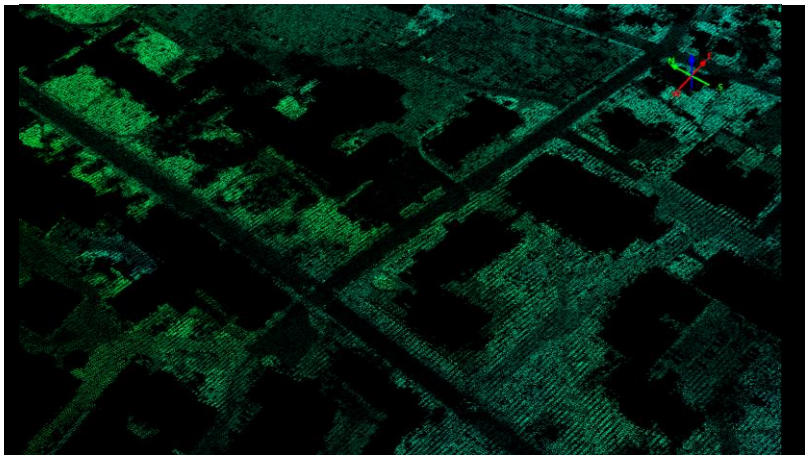


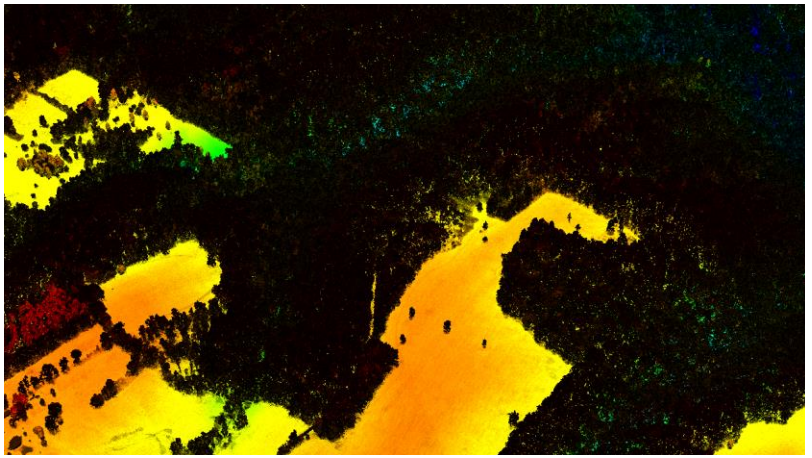
Topographic LiDAR Examples

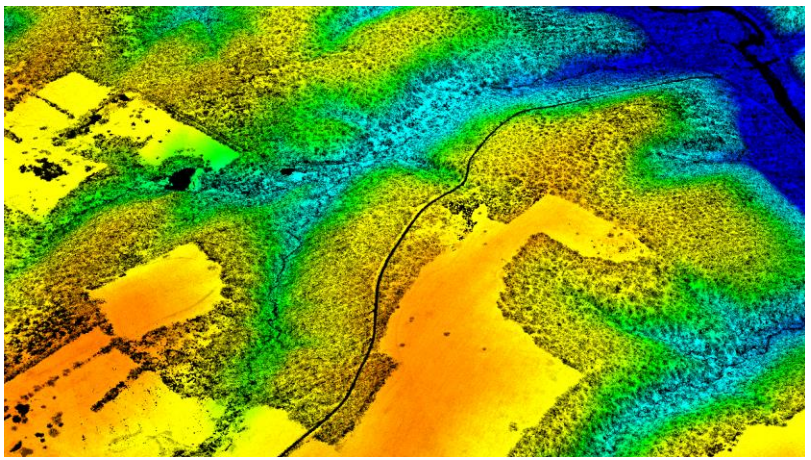






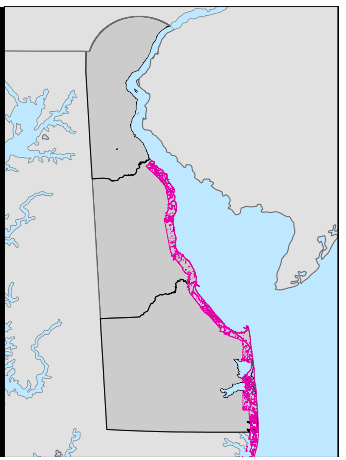


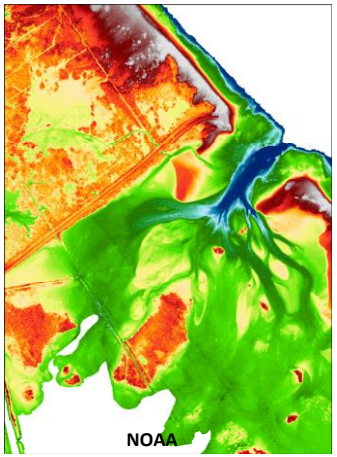




NOAA/NGS LiDAR

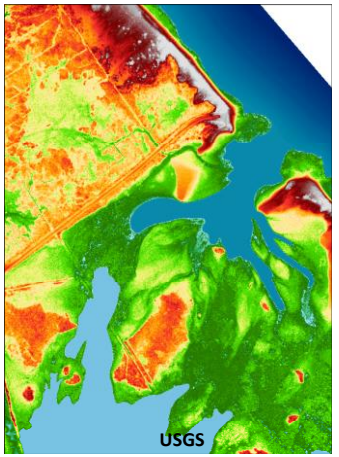
- NOAA Topobathymetric Lidar
- Green LiDAR (532 nm)
- Tide coordinated +/- 2 hrs
- NOAA ~300-m swath along coast of Sussex and Kent Counties
- 2775 miles^2 of Atlantic Coast from New York to South Carolina
- January – May 2014
- No hydro-flattening
- Average point density: 5-8 pts/m^2 (for ground/bathy)
- Reported RMSEz open terrain: 6.2 cm
- Deliverables: classified point cloud, 1-m DEM

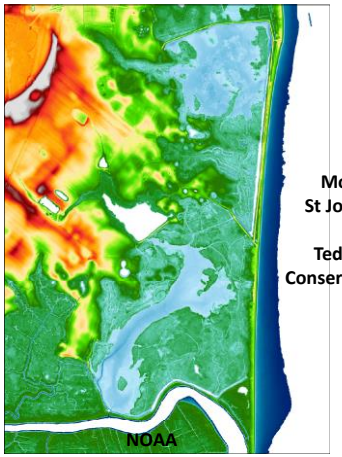




Prime Hook

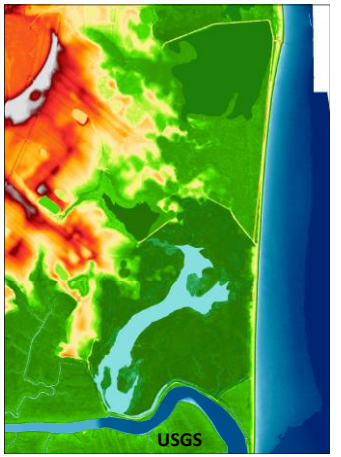
Fowler Beach

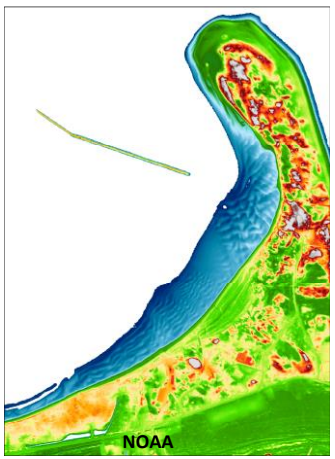




Mouth of St Jones River

Ted Harvey Conservation Area





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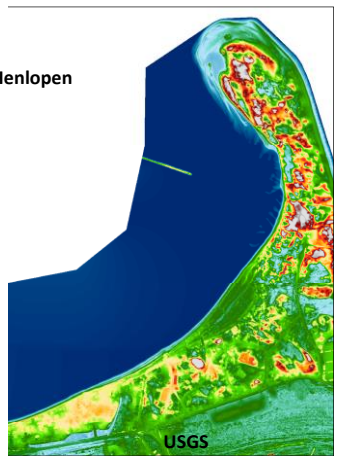
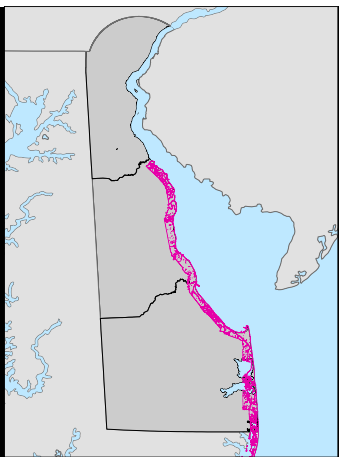


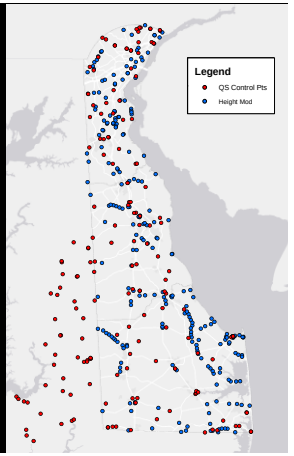
USGS and NOAA LiDAR

- NOAA Topobathymetric LiDAR of limited spatial extent
- Focus on USGS topographic LiDAR for many applications

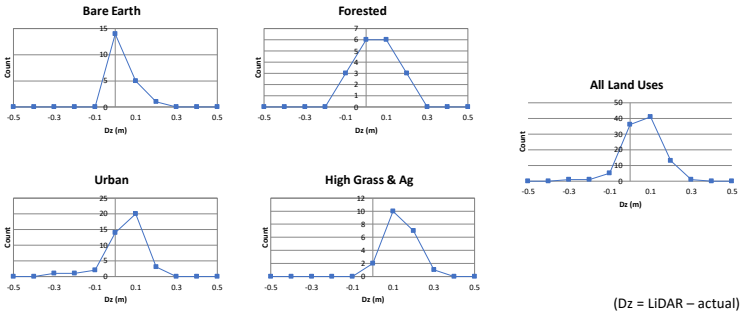


QA/QC

- Replicated Quantum Spatial's analysis
  - Control points (177 total, 118 in Delaware)
- Additional control points
  - Updated when Delaware Height Modernization data becomes available (~240 points; DNREC Coastal Programs)
- Examining QA/QC in the context of Land Use



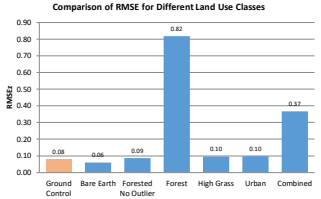
Distribution of Errors
Quantum Spatial Control Points



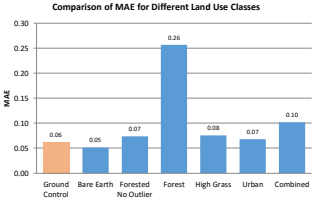
(Dz = LiDAR – actual)

Errors for Different Types of Land Use
Quantum Spatial Control Points

RMSE (Root Mean Square Error)



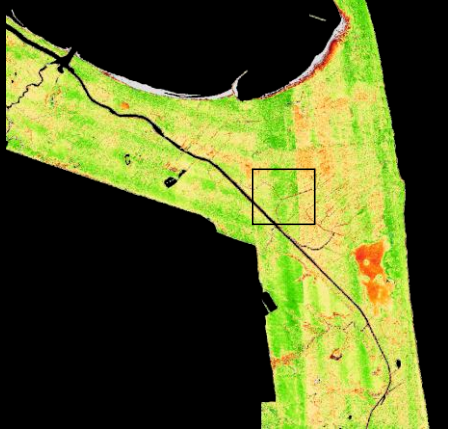
MAE (Mean Absolute Error)



Forest results are highly affected by a single point with high Dz (3.55 m)
Without this point, Forest RMSEz = 0.09 m and MAE = 0.08 m

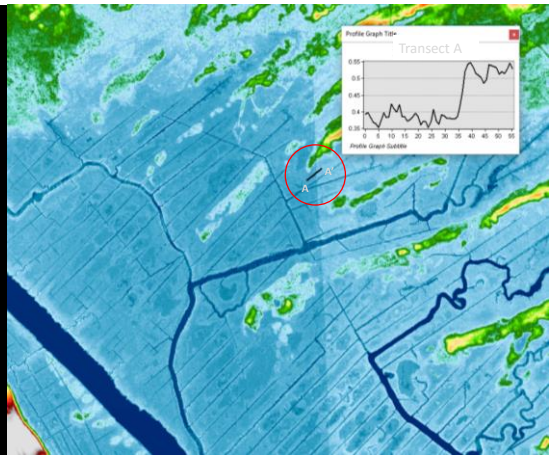
Striping

- Difference grid (USGS - NOAA)
  - Red = USGS Higher
  - Green = NOAA Higher
- Striping from flight lines in both datasets



USGS DEM Striping

- Differences are within specifications
- Be aware of the data biases and limitations when using

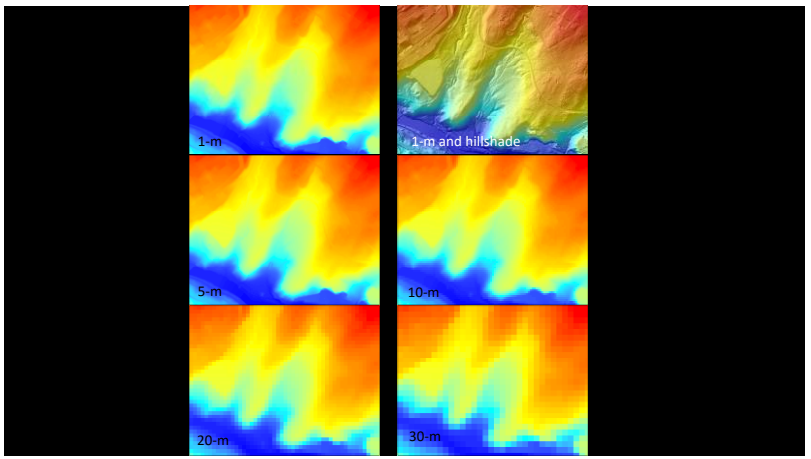


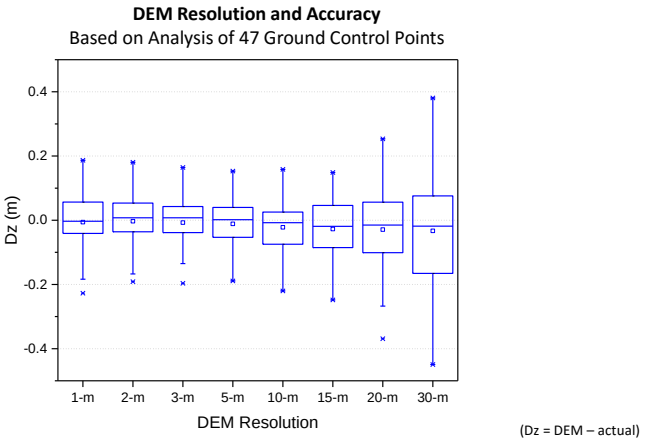
DEM Resolution and Accuracy

- Resampled (aggregated) DEM to:
  - 2-m
  - 3-m
  - 5-m
  - 10-m
  - 15-m
  - 20-m
  - 30-m

Compare Accuracy

- General shift to higher resolution data as it becomes available
- Still some applications, especially modeling, where lower resolution grids are needed



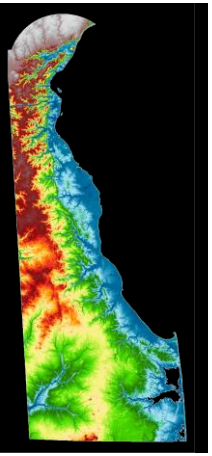


Creating Derivatives

- Hillshade
- Aspect
- Slope

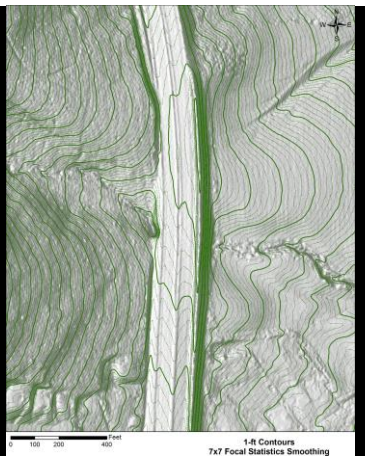
1-ft Contours
- Cartographic purposes
- More exact for site-level assessments

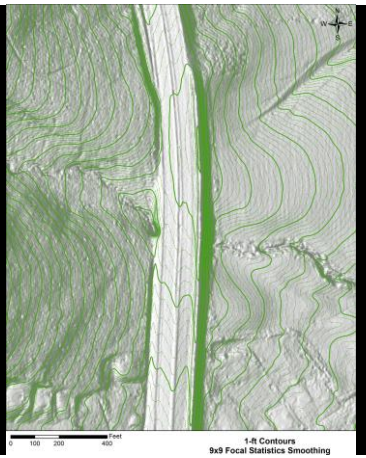
Derived products for specific applications



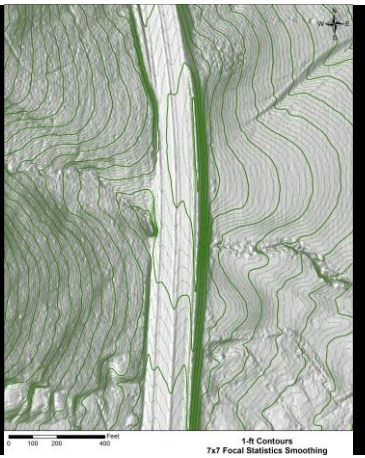
Contours

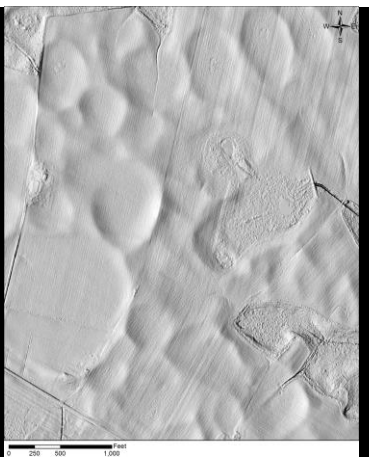
- Producing 1-ft contours for the entire state
- Smoothing necessary to make cartographic contours
  - Focal statistics – uses a local neighborhood to compute the mean

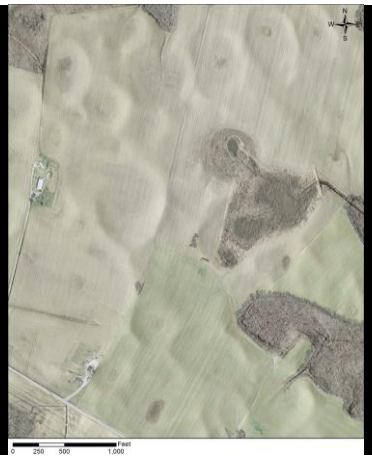


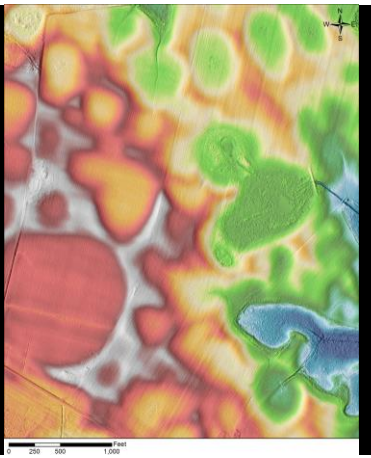


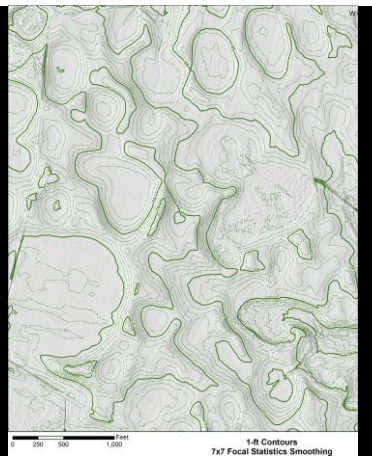
7x7 Focal Statistics smoothing will be used to produce cartographic contours











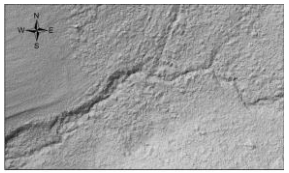
Additional Applications

- Streamlines
- Wetted stream area

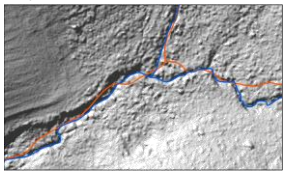
Streamlines

- High-resolution LiDAR TIN for the Christina River Basin Critical Zone Observatory was used to update the stream centerline for the first through third-order streams of the White Clay Creak watershed above McCue Road

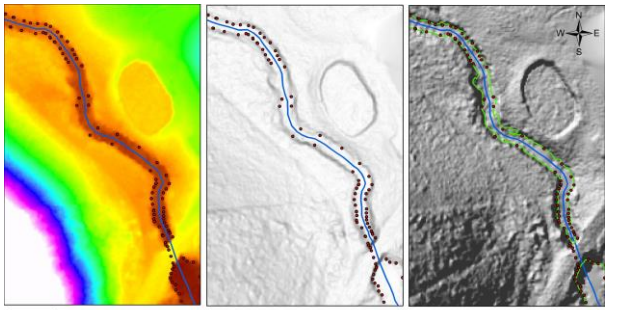
Leaf-off bare-earth TIN near the intersection of two first-order steams



0.5-m hillshade image and both the previous and LiDAR-derived stream centerlines.

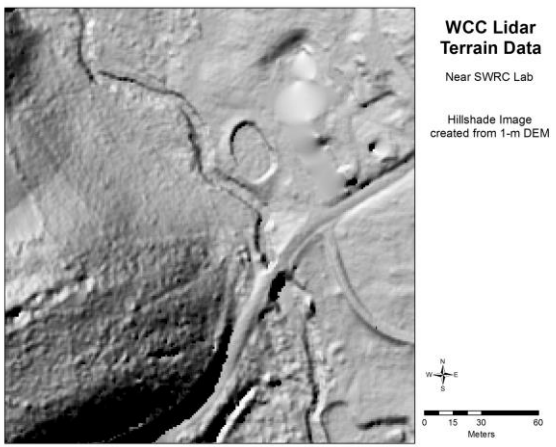


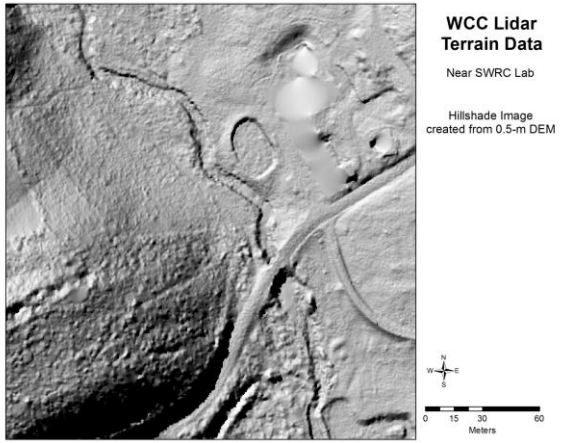
LiDAR derived stream centerline and channel boundaries for White Clay Creek near Spencer Road Bridge (drainage area of 7.24 km^2)



Applications

- Knowledge of channel width and wetted area are important for geomorphological, biogeochemical, and biological studies (*e.g.*, sedimentation, gas exchange, habitat).
- Stream channel "breaklines" can be used to examine channel width, but they are usually created from photogrammetry and do not extend to low-order channels.
- LiDAR derived slope is a good indicator of channel boundaries.



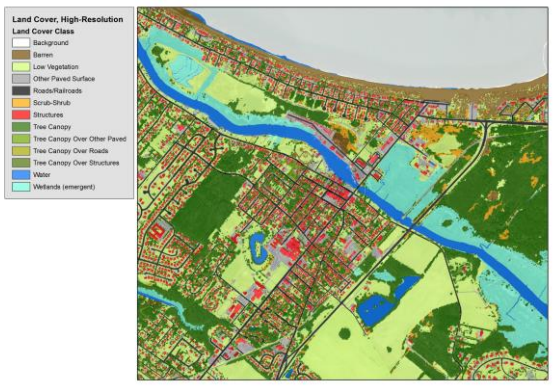


Additional Applications

- Shoreline
- Vegetation
  - Urban tree canopy
  - Reforestation
  - Biomass
- Habitat analysis
  - Old growth forest
  - Habitat connectivity
- Supplement Survey Data
- Buildings
- Storm Surge Modeling
- Land cover

High-Resolution Land Cover

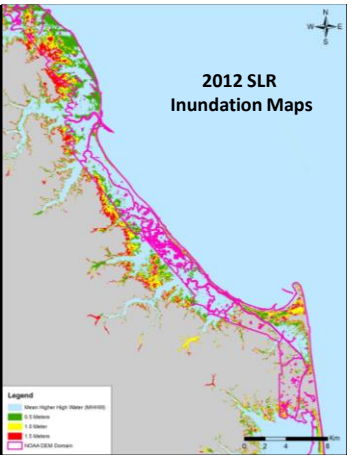
- 1-m Land Cover dataset for all of Delaware based on 2014 LiDAR data and 2012/2013 imagery
- University of Vermont Spatial Analysis Lab - Jarlath O'Neil-Dunne
- http://letters-sal.blogspot.com/2016/03/delaware-high-resolution-land-cover.html
- Classes
  - 0 - Background
  - 1 - Water
  - 2 - Emergent Wetlands
  - 3 - Tree Canopy
  - 4 - Scrub/Shrub
  - 5 - Low Vegetation
  - 6 - Barren
  - 7 - Structures
  - 8 - Other Paved Surfaces
  - 9 - Roads/Railroads
  - 10 - Tree Canopy over Structures
  - 11 - Tree Canopy over Other Paved Surfaces
  - 12 - Tree Canopy over Roads



Sea-Level Rise Inundation

- 2016 Delaware SLR Technical Committee
- Delaware Geological Survey
  - Coordinating for DNREC
- Review sea-level rise research
  - update planning scenarios/inundation maps
- 2014 LiDAR-based DEM
  - bathtub-model SLR coastal inundation maps
- Sea-Level Rise planning scenarios,
  - Mean Higher-High Water (MHHW) to 7 ft above MHHW, in 1 foot increments
  - advise long-range planning of infrastructure, facilities, land management, land-use, and capital spending

DELAWARE COASTAL PROGRAMS DCMP



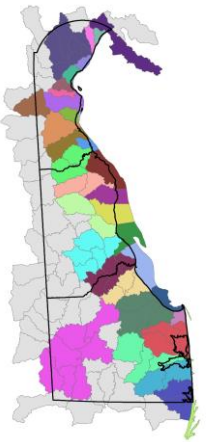
Sea-Level Rise Inundation

- Project Information: http://www.dgs.udel.edu/projects/determination-future-sea-level-rise-planning-scenarios-delaware
- Mapping Methodology: http://www.dgs.udel.edu/sites/dgs.udel.edu/files/projects-docs/SLR_Mapping_Methodology.pdf

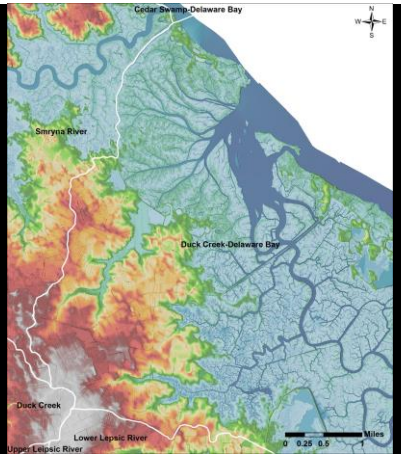
DELAWARE COASTAL PROGRAMS DCMP

Identify watersheds potential affected by sea-level rise

65 watersheds

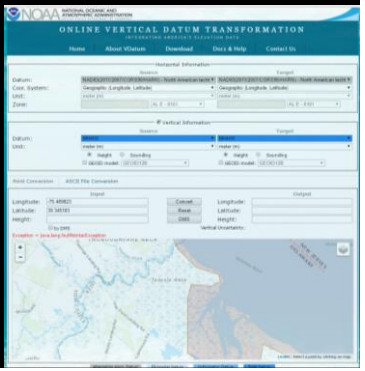


Start with hydro-flattened DEM with a few manual corrections

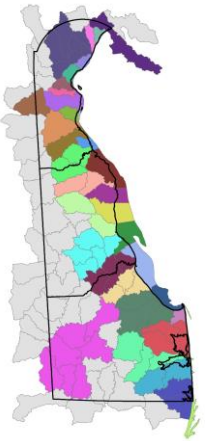


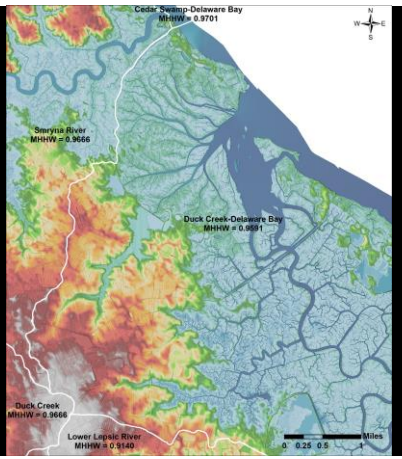
MHHW for Each Watershed

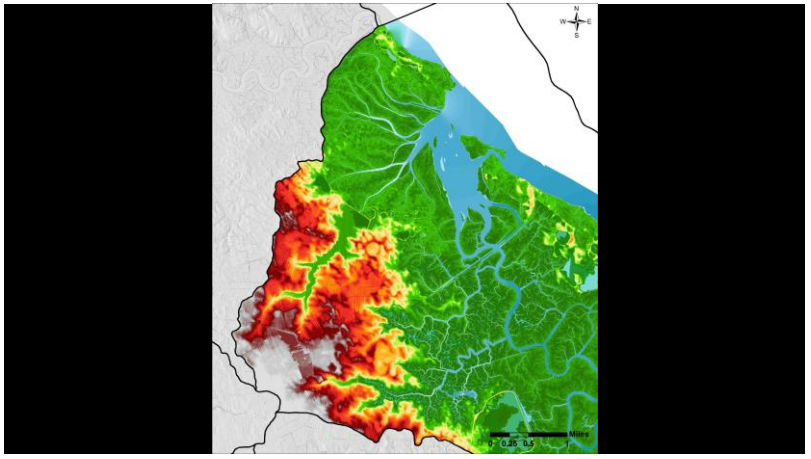
- Used NOAA's VDatum tool to determine MHHW at the mouth of each coastal watershed

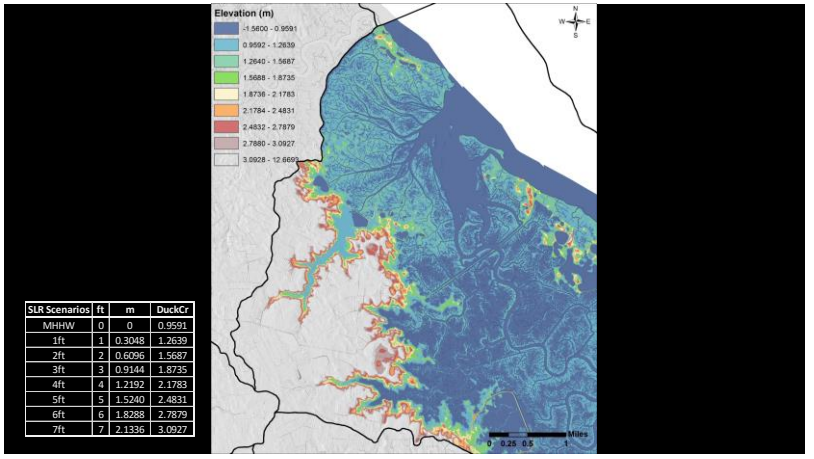


Grouped by MHHW – resulting in 35 watersheds for analysis

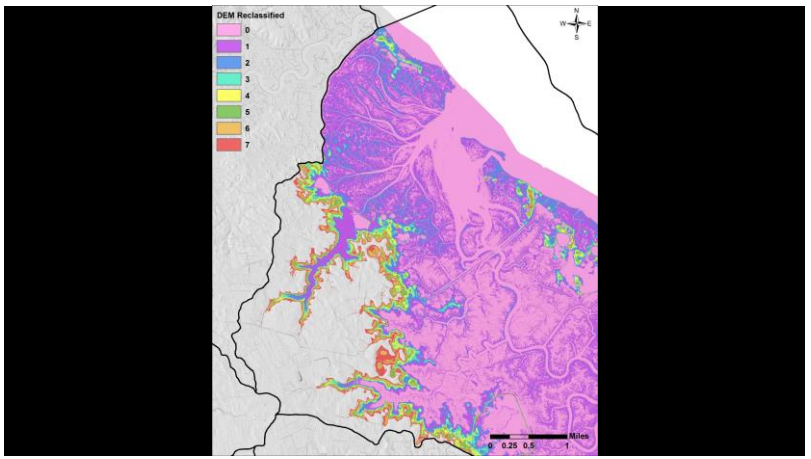


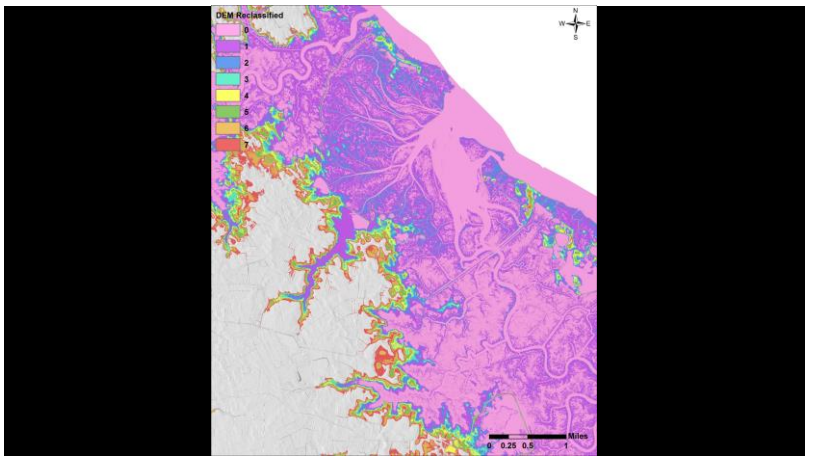




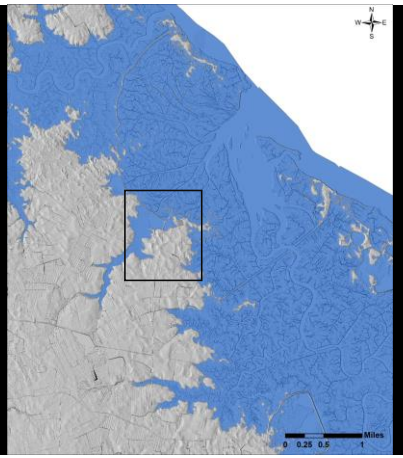


SLR Scenarios	ft	m	DuckCr
MHHW	0	0	0.9591
1ft	1	0.3048	1.2639
2ft	2	0.6096	1.5687
3ft	3	0.9144	1.8735
4ft	4	1.2192	2.1783
5ft	5	1.5240	2.4831
6ft	6	1.8288	2.7879
7ft	7	2.1336	3.0927





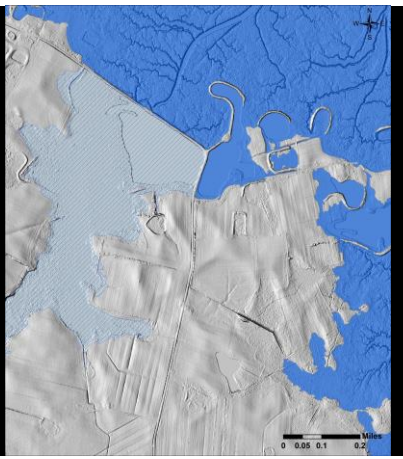
Scenario:
SLR = 2ft



Scenario:
SLR = 2ft

Scenario:
SLR = 2ft

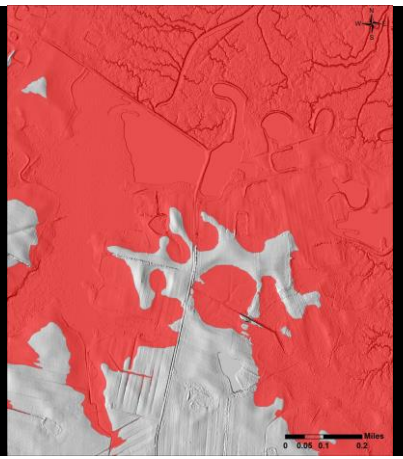
Scenario:
SLR = 2ft

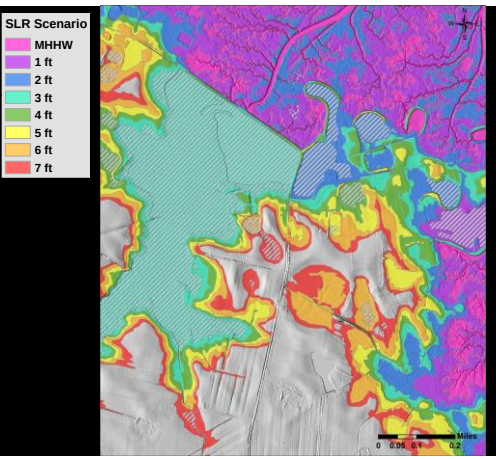


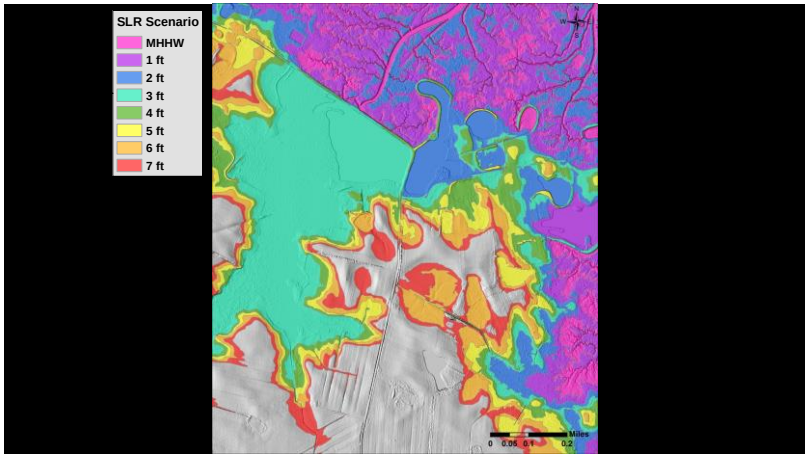
Scenario:
SLR = 3ft

Scenario:
SLR = 3ft

Scenario:
SLR = 7ft

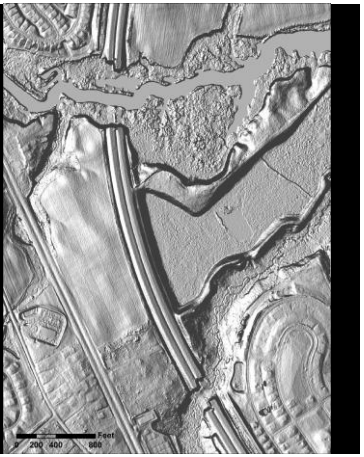


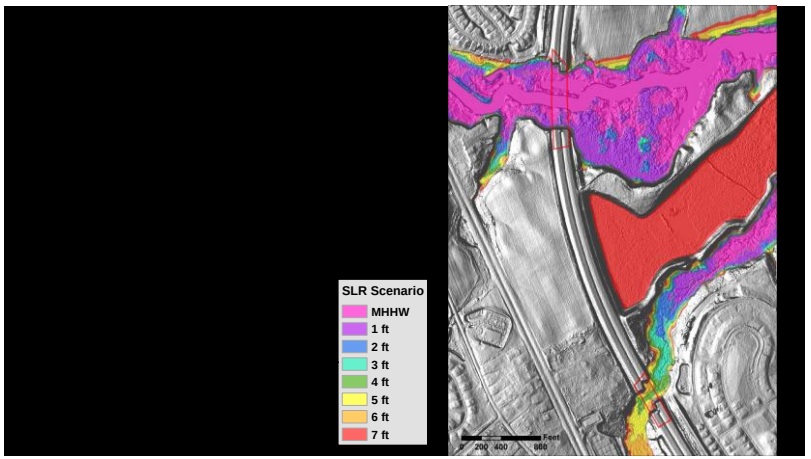


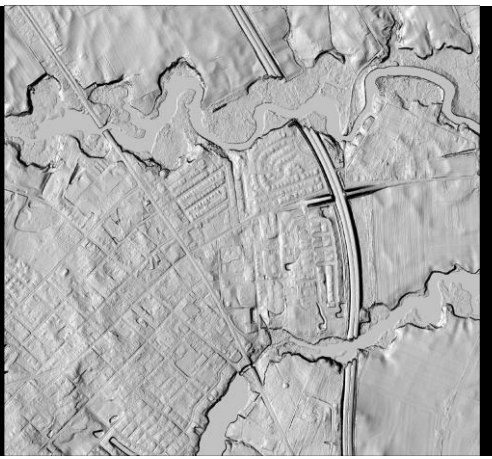


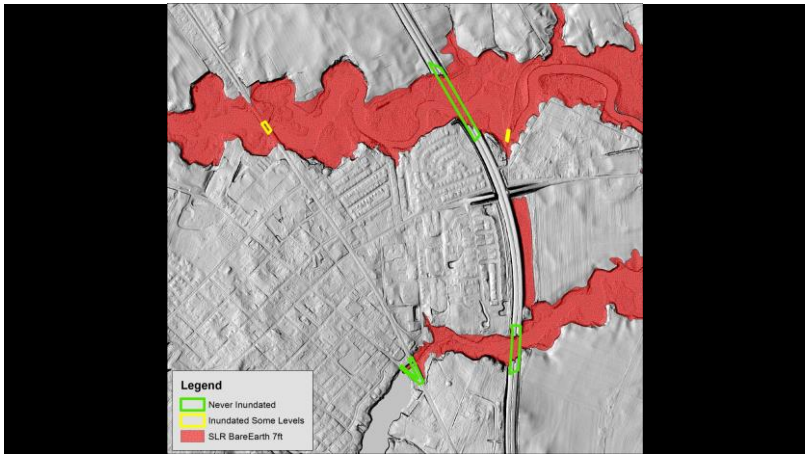
Elevated Roadways

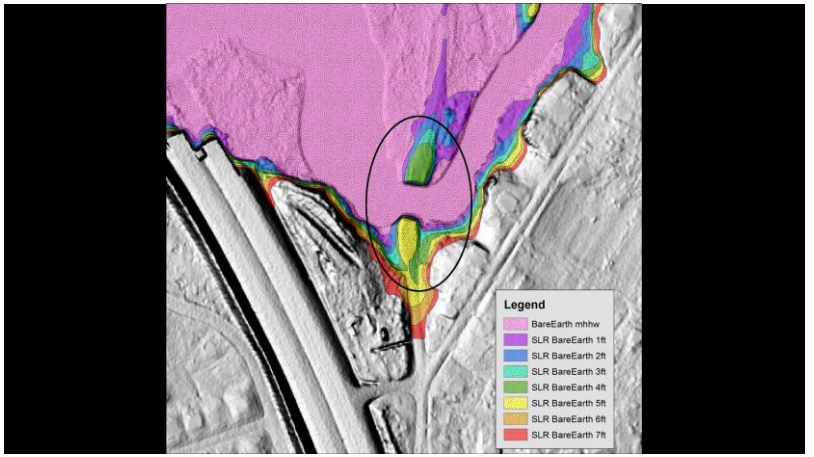
- Elevated Roadways often removed from Bare Earth DEM
- Important to know how these roadways affected by SLR
- Manually adjust SLR maps

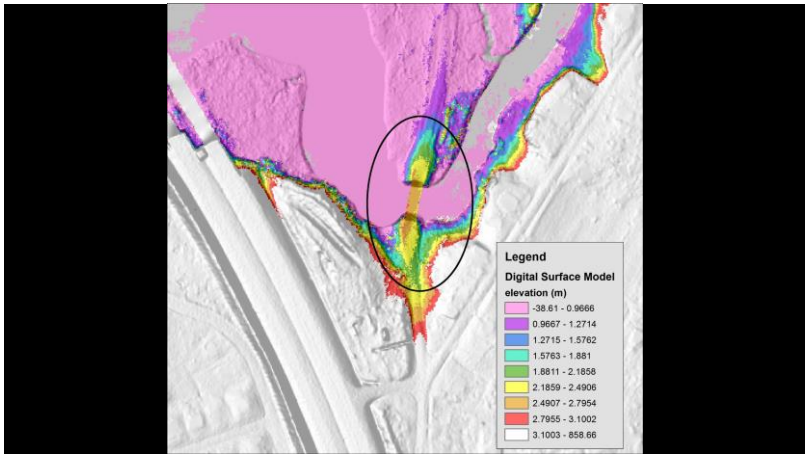


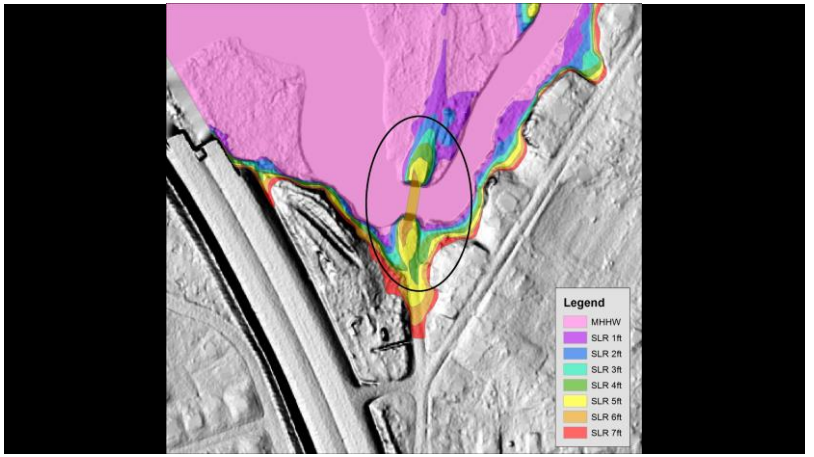


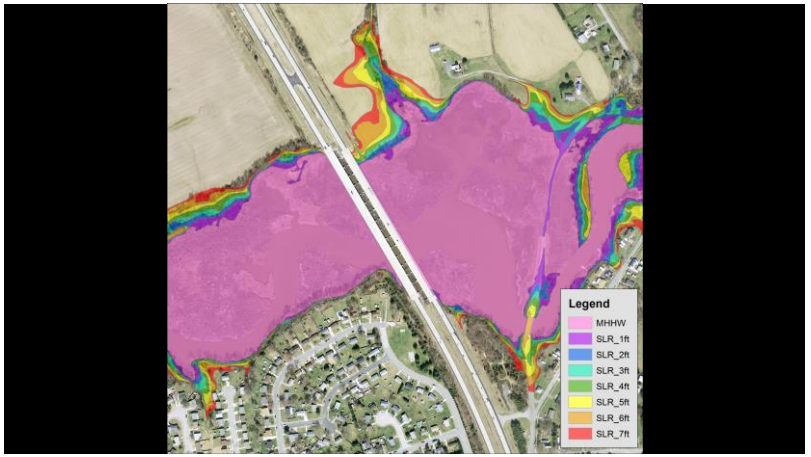



Legend
Never Inundated
Inundated Some Levels
SLR BareEarth 7ft

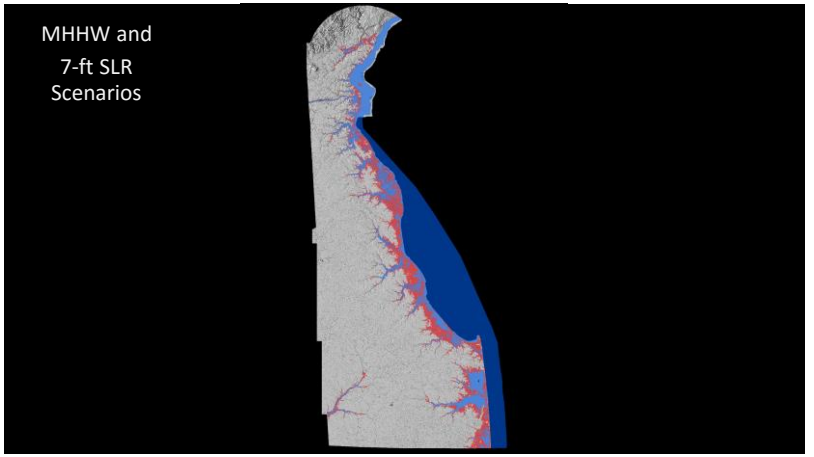

Legend
BareEarth mhhw
SLR BareEarth 1ft
SLR BareEarth 2ft
SLR BareEarth 3ft
SLR BareEarth 4ft
SLR BareEarth 5ft
SLR BareEarth 6ft
SLR BareEarth 7ft


Legend
Digital Surface Model
elevation (m)
-38.61 - 0.9666
0.9667 - 1.2714
1.2715 - 1.5762
1.5763 - 1.881
1.8811 - 2.1858
2.1859 - 2.4906
2.4907 - 2.7954
2.7955 - 3.1002
3.1003 - 858.66


Legend
MHHW
SLR 1ft
SLR 2ft
SLR 3ft
SLR 4ft
SLR 5ft
SLR 6ft
SLR 7ft



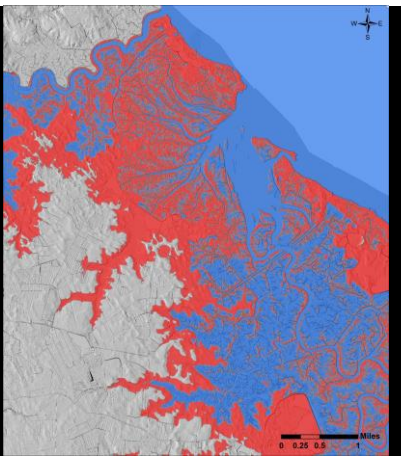
MHHW and 7-ft SLR Scenarios



Please Note!

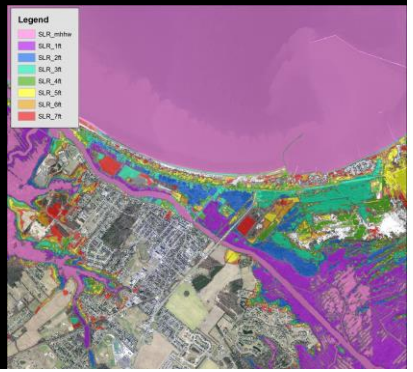
- Users should be aware that the LiDAR data upon which these maps are based represents the land surface as it was when data was collected in Winter 2013-2014 may not be representative of current conditions.
- Areas where considerable change to the land surface is known to have occurred included the following: Prime Hook, Dikes near New Castle
- Users should also be familiar with LiDAR data collection accuracy, errors, and systematic biases.
- It should also be noted that these maps are based on a bathtub model which assumes a constant water surface throughout each watershed.

MHHW and 7-ft SLR Scenarios



Sea-Level Rise Inundation Final Products

- Geodatabase layers include surfaces from Mean Higher-High Water (MHHW) to 7 feet above MHHW, in 1-foot increments
- Bare earth bathtub-model SLR coastal inundation mapping
- SLR coastal inundation mapping with elevated roadways and bridges accounted for



Sea-Level Rise Inundation Products

- Draft available for review now on FirstMap in the private environment for Delaware State users: http://firstmap.dti.state.de.us/arcgis/rest/services
- Send comments by December 10.
- Hope to publish final product publicly on FirstMap and OpenData by January 1, 2017.

Comparison With Other Flooding Maps

- FIRM – FEMA
  - Hydrodynamic model
  - Regulatory products
- FRAM – 100 year FIRM + 3ft SLR
  - Hydrodynamic model + bathtub model
  - Screening level took for state agency planning
- 2016 SLR Inundation
  - Bathtub Model
- Projections not Predictions

Questions?

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